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# ADDITIONAL NOTES ON BATOID FISHES FROM THE WESTERN ATLANTIC[1]

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[1] Contribution No. 1875 from the Woods Hole Oceanographic Institution.

## INTRODUCTION

During the last fifteen years we have received for study a large number of interesting batoids, together with some cyclostomes, sharks, and chimaerids, trawled by U.S. Fish and Wildlife vessels, chiefly the "Oregon" and the "Silver Bay" but also the "Combat," "Pelican," and "George M. Bowers." Most of these were taken in the Gulf of Mexico, the Caribbean, and along the coast of South America as far south as 01°49′N off the mouth of the Amazon, with a few from along our eastern coast to the southward of Cape Hatteras. Bottom trawling depths ranged from 40 to 750 fathoms (65-1370 m), chiefly between 100-500 fathoms (183-915 m). Many new species are included in our various reports from 1951 to 1965, listed in the references cited.

The present account includes eighteen species of batoids, none of them new, but they yield additional information as to range, depths of capture, size, etc. They were taken at 95 "Oregon" and 10 "Silver Bay" stations which fall within the following depth ranges: 10 at 40-100; 11 at 101-200; 60 at 201-300; 13 at 301-400; 8 at 401-500; and 3 stations at 501-600 fathoms, ranging from northern Florida to Venezuela, including the Gulf of Mexico. Also included is a summary of previously published capture records for each species.

We thank the various investigators who collected and preserved these specimens, and Harvey R. Bullis, Jr., of the U. S. Fish and Wildlife Service for placing them at our disposal.

### Order BATOIDEI

### Suborder TORPEDINOIDEA

### Family TORPEDINIDAE

### TORPEDO NOBILIANA Bonaparte 1835

Our recent accounts (1962, 1965) of this species include the capture of 12 specimens, ranging in length from 211 to 700 mm, trawled in various localities ranging from North Carolina to the Caribbean coast of Panama (9°00′N, 81°23′W), including the Gulf of Mexico, in depths of 10 to 290 fathoms (18 to 530 m). It is known in the western Atlantic from as far north as the offing of southern Nova Scotia and in the eastern Atlantic from northern Scotland to the Mediterranean, Azores, Madeira, and tropical West Africa.

The present collection includes 12 specimens, 205 to 393 mm long, 3 from the east coast of Florida, 1 from the east coast of Hispaniola, and 8 from off the coast of Venezuela, in 40 to 240 fathoms (73 to 440 m), "Oregon" stations 4393, 4394, 4401, 4402, 4418, 5037, 5101, 5109 and "Silver Bay" stations 5188, 5530.

An examination of a number of recently obtained specimens, necessitates a modification of two descriptive characters given in *Fishes of the Western North Atlantic, Part 2* (Bigelow and Schroeder, 1953, p. 94), stated as "disc appreciably shorter (less than 80 per cent) than its breadth" and "height of caudal fin not greater than distance from its own upper origin to origin of first dorsal."

Four males 215-900 mm long and seven females of 211-613 mm have a disc length ranging from 77 to 90 per cent of the disc width, only two individuals falling below 80 per cent. The height of the caudal is greater, 1.10 to 1.38 times, than the distance from the upper origin of the caudal to the origin of the first dorsal on 10 specimens and less, 0.95 times, on only one.

In color, this ray has been described as dark chocolate to purplish brown above, either uniform or with a few obscure darker spots, and white below, but with the edges of the disc and pelvics of the same hue as the upper surface, the tail with irregular dark markings. Our specimens likewise are so colored above but the markings below on several are grayish. It is reputed to reach a weight of about 200 pounds.

## DIPLOBATIS PICTUS Palmer 1950

The type of this species was taken off Georgetown, British Guiana, a female 137 mm in total length. Our recent account (1962) includes 24 specimens, 77-164 mm long, from the mouth of the Amazon 02°29′N to British Guiana 09°31′N in 9-50 fathoms (16-92 m).

The present collection includes 3 males of 85-159 mm and 3 females of 140-196 mm from 12°19′-12°37′N, 70°34′-71°10′W, off the mouth of the Gulf of Venezuela, in 40-65 fathoms (73-119 m), "Oregon" stations 4393, 4394, 4401, 4402.

In our 1962 account we mentioned certain characters that supposedly differentiated *D. pictus* from *D. guamachensis* Martin 1957. Thus we stated that in 21 specimens of *pictus,* 77 to 164 mm long, the width of disc ranges from 38.8 to 50.0 per cent, the length of disc from 38.8 to 48.0 per cent, and the breadth of pelvics from 28.7 to 36.6 per cent of total length; also that the lateral folds originated between the rear end of the first dorsal base and the origin of the second dorsal. In a personal communication received from Dr. Martin in 1959, based on 4 specimens of *guamachensis* 56.5-70.9 mm long (including the type), from the Gulf of Cariaco, Venezuela, the above proportions are given as 53.0 to 58.1, 50.3 to 54.5, and (on two specimens) 23.8-26.0, respectively, the lateral folds originating "immediately behind the origin of first dorsal."

The color and markings on *pictus* vary considerably and our earlier collection does not include any with the design of *guamachensis* with its irregular dark bars and spots. However, in our present collection of 6 specimens, two males 85 and 196 mm long, respectively, are marked much like Martin's illustration, though somewhat more elaborately. This variation in the markings on *pictus* recalls that of *Narcine brasiliensis.* Furthermore, they fall in line with the proportional dimensions of all our other *pictus* and also confirm that the lateral folds originate between the dorsal fins and not immediately behind the origin of the first dorsal. We therefore consider *D. guamachensis* a synonym of *D. pictus.*

The known range of this species now extends from the offing of the Gulf of Venezuela to that of the Amazon River and in depth from 9 to 65 fathoms (16-119 m).

## Suborder RAJOIDEA

### Family RAJIDAE

### RAJA BULLISI Bigelow and Schroeder 1962

Specimens previously recorded (1962, 1965), 166 to 478 mm long, range from Dry Tortugas, Florida, 24°36'N, to the coast of Surinam, 07°15'N, in 110-300 fathoms (201-549 m).

Three specimens are included in the present collection: a 205 mm female from off Santa Marta, Colombia, 11°08'N, 74°23.8'W, in 100 fathoms (183 m), "Oregon" station 4856; a 280 mm female 11°31'N, 60°51'W, in 240-250 fathoms (440-457 m), station 5029; and a 370 mm male 11°36.5'N, 62°46.5'W, in 200-240 fathoms (366-440 m), station 5037, from the offing of the Gulf of Paria, Venezuela.

*Bullisi* closely resembles *Raja teevani* but its persistent nuchal thorn, somewhat broader tip of snout, and somewhat greater space between the dorsals (0.23 to 0.45 times the first dorsal base) distinguish it from the latter which lacks a nuchal thorn, has a very sharp tip of snout, and dorsals that are confluent or with an interspace seldom exceeding 0.15 times the first dorsal base.

### RAJA CERVIGONI Bigelow and Schroeder 1964

Previous records of this species include: an immature male of 357 mm, the holotype, from 10 miles (16 km) northeast of Carúpano, in 20-30 fathoms (37-55 m), Museo Historia Natural La Salle, Venezuela, No. 873; a male of 206 mm, and a female of 229 mm from Punta Araya, Estado Sucre, in about 20 fathoms (37 m), off the eastern part of Venezuela; and a male of 235 mm from off the Guianas, 07°25′N, 54°35′W, in 75-80 fathoms (137-146 m), "Oregon" station 2289.

The present collection includes 2 males, 144 and 506 mm long, respectively, the latter mature, and a female of 418 mm, from off the Peninsula de Guajira, Venezuela, 12°29′N, 71°54′W, in 95 fathoms (174 m), "Oregon" station 5685.

*Description of mature male.* Proportional dimensions in per cent of total length.

Disc. Extreme breadth 69.5; length 50.2.

Snout length. In front of orbits 10.7; in front of mouth 13.5.

Orbits. Horizontal diameter 4.4; distance between 4.2.

Spiracles. Length 2.8; distance between 6.1.

Mouth. Breadth 8.1.

Exposed nostrils. Distance between inner ends 7.9.

Gill openings. Length 1st 1.7; 3rd 1.7; 5th 1.5; distance between inner ends, 1st 13.8; 5th 7.3.

First dorsal fin. Height 2.8; length of base 4.9.

Second dorsal fin. Height 2.8 length of base 4.9.

Pelvics. Anterior margin 12.1.

Distance. From tip of snout to center of cloaca 46.5; from center of cloaca to 1st dorsal 36.5; to tip of tail 53.5; from rear end of 2nd dorsal to tip of tail 3.4.

Interspace. 1st and 2nd dorsals 3.8.

Disc 1.38 times as broad as long; maximum angle in front of spiracles 99°; anterior rays of pectorals extending 50 per cent of distance from level of orbits toward tip of snout, the latter projecting; rostral process firm, extending to tip of snout; anterior margins of disc slightly convex in front of spiracles, thence concave and straight toward outer corners which are sharply rounded, the width of disc across anterior edge of orbits 25 per cent of total length of specimen; posterior margins and corners and inner margins all rounded. Axis of greatest breadth 71 per cent of distance back from tip of snout to axils of pectorals. Tail rather slender, the lateral folds low down, narrow, originating a little in advance of tips of pelvics, reaching tip of tail; length of tail from center of cloaca to origin of first dorsal 0.78 times as great, and to its tip 1.15 times as great as distance from center of cloaca to tip of snout.

A row of 9 thorns along anterior and inner margins of one orbit, 10 along the other, and 3 minute thorns opposite inner margin of each spiracle with several small ones over tip of rostrum. Three prominent thorns along midline in the nuchal region, followed by a space and the next thorn, a tiny one, opposite the axils of pectorals, with 6 more to opposite tip of anterior pelvic lobe, then 22 thorns alternating large and small in an unbroken series to the first dorsal fin; 2 thorns in front of second dorsal. A row of 21 thorns low down each side of the midrow on tail, more or less alternating in size, beginning a little in advance of tips of posterior pelvic lobe and reaching to opposite origin of first dorsal. Malar thorns prominent, sharp, backward pointing, each patch consisting of 3 to 4 rows 40 mm long and 16 mm wide. Alar thorns well developed, each patch about 60 mm long and 13 mm at widest, the rows irregular, as many as 5 rows anteriorly reducing to a single thorn posteriorly. A band of fine prickles along edge of disc from opposite posterior malars to outer angle. Upper surface otherwise smooth. Lower surface with a patch of prickles on end of snout merging with a narrow band of prickles along edge of disc extending to about opposite mouth; otherwise smooth below.

The claspers are massive, extending 75 mm beyond the tips of pelvics.

*Color*. Upper surface plain medium brown. A prominent ocellus on each side of disc, situated a little posterior to the greatest axis of disc, its center from the midline of disc a distance about equal to that from tip of snout to center of orbit; distance between centers of ocelli 133 mm, and between centers of ocelli and centers of orbits 127 mm. The ocelli have a pale center surrounded by a roundish area of solid dark brown the diameter of which is about 9 to 11 mm, thence a pale area surrounded by a narrow, somewhat broken dark brown circle about 21 mm in diameter and finally with an outside narrow pale circle. Lower surface of disc and pelvics margined with a band of pale grayish, the tail with brownish blotches.

The 144 mm male has a disc 1.45 times as broad as long; maximum angle in front of spiracles 109°; contour of disc about the same as the 506 mm male, except that width across anterior edge of orbits is 34.7 per cent of total length of specimen; axis of greatest breadth 72.6 per cent; length of tail to origin of first dorsal 0.72 times as great and to its tip 1.08 times as great as distance from center of cloaca to tip of snout. Two thorns along anterior margin and 1 at inner posterior margin of each orbit; 1 nuchal thorn; a row of 16 large, sharp, thorns in midline, evenly spaced, from opposite axils of pectorals to first dorsal and 2 between dorsals; a row low down each side of midrow, from opposite tip of pelvics to interdorsal space, 11 on one side 12 on the other, in size about the same as those in midrow; otherwise smooth above. Smooth below except for a single row of 6 to 7 very small spines along edge of disc between tip of snout and nostrils. Claspers not reaching tip of pelvics. The distance of the center of each ocellus from the midline of disc is equal to that from tip of snout to anterior margin of orbit; distance between centers of ocelli 40 mm and between centers of ocelli and centers of orbits 35.5 mm. The ocelli have a dark brown center and an outside solid dark brown circle 6 mm in diameter, with a pale area between and another surrounding the colored areas. The lower surface is marked with a broad outer band of gray from opposite mouth to axils of pectorals, its inner margin irregular, and with a pair of irregular grayish blotches at the origin of the anterior pelvic lobes and on the tips of the posterior lobes, the tail with two vague grayish areas posteriorly.

The 418 mm female agrees closely with the small male in proportional dimensions. The ocular and nuchal thorns are of the same number as on the 506 mm male but the midline thorns are more numerous, there being 6 very small ones from opposite the ocelli to the axils of pectorals followed by 30, alternating large and small, to the first dorsal, with 2 small thorns and 1 large between the dorsals. The side row contains about 35 thorns extending from near axils of pectorals to opposite the second dorsal, more or less alternating in size, but the posterior 5 or 6 very small. The prickles along the edge of disc anteriorly, above and below, are similar to those of the large male. The distance between the centers of the ocelli is 117 mm and between centers of ocelli and centers of orbits 98 mm. Color above and below similar to the large male. The tooth count on the 7 specimens thus far examined ranges from $\frac{34}{32}$ to $\frac{42}{40}$.

### RAJA CLARKII Bigelow and Schroeder 1958

Our previous records of *R. clarkii* (1958, 1962, 1965) include a total of 4 males 228-665 mm long, and 4 females of 176-747 mm. Four were trawled in the northern part of the Gulf of Mexico, 3 off the coast of Nicaragua and 1 off Panama, in depths ranging from 200 to 300 fathoms (366-549 m).

The present collection includes 3 males of 330-710 mm from the north central part of the Gulf of Mexico, "Oregon" stations 4701, 4703, 4716; 6 males of 265-525 mm and 2 females of 256-370 mm from off Colombia, stations 4841, 4882, 5689, 5690, 5722; and a male of 351 mm and 2 females of 250-275 mm off Venezuela, stations 4438, 4456. These stations range in depth from 220 to 500 fathoms (400-915 m).

This species is characterized among western Atlantic rajids by the presence of a band of formidable and very sharp thorns extending along the margin of the lower surface from the tip of the snout almost to the outer corners of the disc. An amplification of previous descriptions follows.

The median row of thorns, which is continuous from the nuchal region to the first dorsal fin, number from 30 to 43 of which 4 or 5 are in the nuchal-scapular area followed by about 7 to opposite axils of the pectorals. The total number of thorns does not necessarily increase with the size or age of the skate, for a male and a female, 256 and 324 mm long, respectively, have 43 thorns while a male and a female of 710 and 747 mm have only 37-38 in the median row. There is a triangular patch of thorns in the nuchal-scapular area which may have but 1 thorn on each side of the midrow or as many as 4 or 5. In arrangement, the orbital thorns on most of our specimens, including the largest, consist of 2 anterior, 1 posterior, and from 1 to 3 aside the spiracles.

The color of the upper surface of all the specimens we have seen is brown with darker punctulations scattered over the disc, pelvics, and more or less on the tail. Some have conspicuous white spots while others lack them. Thus 5 specimens, 250-747 mm long, have 3 pairs of spots, 8 of 265-580 mm have 1 pair, and 8 of 176-525 mm lack them. One specimen of 710 mm has 1 pair anteriorly and 1 spot on one side posteriorly. It is noteworthy that the spots are located in the same parts of the disc. Thus the anterior pair is opposite the spiracles, the median pair, slightly closer together, opposite the scapular region, and the posterior pair a little in advance of axils of pectorals and about in line with the anterior pair. Where but one pair is present it is located anteriorly. In shape the spots may be barlike, oval, or spherical, and in size, if roundish, from less than to about equal to the area of the orbit, or, if barlike, about as long or longer than the diameter of the orbit. The lower surface is white with a broad grayish band, its inner margin irregular (Bigelow and Schroeder, 1958, fig. 9; 1965, fig. 1) extending on most specimens from a little in advance of the outer angles of disc to the axils of the pectorals and along the rear margin of the pelvics, but on several this band originates near the tip of the snout. Also, a few small gray spots or blotches may be present here and there on the disc, including one each side of the cloaca.

The largest male, 710 mm in length, is approaching maturity as the claspers are well developed, extending 56 mm beyond the tips of the pelvics, and a few of the alar thorns are exposed.

The present known range of this species is from the northern part of the Gulf of Mexico to the offing of Colombia (12°30′N, 72°08′W) in 200-500 fathoms (366-915 m).

### RAJA FLORIDANA Bigelow and Schroeder 1962

The original account of this species includes 27 specimens 158-448 mm long, and 1, the holotype of 772 mm, trawled between Cape Lookout, North Carolina, and Dry Tortugas, Florida, 34°21′ to 24°17′N, in 170-225 fathoms (311-412 m).

The present collection includes 32 specimens, 145-585 mm long, males and females about equally divided, taken at 12 "Oregon" stations (5097, 5098, 5100, 5101, 5102, 5106, 5107, 5113, 5119, 5234, 5295, 5482) and "Silver Bay" station 5454. These fall within a small area between the offings of Cape Kennedy and St. Augustine, Florida, 28°00′-29°58′N, 79°51′-80°10′W, in 160-213 fathoms (293-390 m).

In general appearance *floridana* resembles *R. laevis* Mitchill, 1815, but it differs from *laevis* in a proportionately longer snout, wider disc, usually a shorter tail, and smaller dorsal fins. Thus, on 6 males and 3 females of *floridana* 298-772 mm in total length, the distance from the tip of snout to the mouth is 19.5-24.9 per cent, the width of the disc 73.2-81.2 per cent, the length of the tail from center of cloaca 43.8-47.1 per cent, and the distance from origin of first dorsal fin to the rear end of base of second dorsal 8.4-12.1 per cent of total length. These proportions on 2 males and 1 female of *laevis*, 506-542 mm long, are 17.0-18.0 per cent, 68.0-71.0 per cent, 49.7-51.7 per cent and 14.5-14.8 per cent, respectively. On 7 *floridana* 158-240 mm long the distance from snout to mouth is 18.0-21.1, length of tail 46.2-50.5 and there are 8 to 10 tail thorns, whereas on 5 *laevis* of 177-195 mm these proportions are 14.1-17.8 and 54.2-58.7 and the tail thorns 13 to 18.

We are indebted to George C. Miller of the U. S. Fish and Wildlife Service for pertinent data on a collection of 17 specimens, 155-252 mm long, and 1 of 465 mm, all taken between the offing of South Carolina and the Straits of Florida in 180-220 fathoms (329-402 m), except one from 29°04′N, 88°31′W, "Oregon" station 3724, the latter extending the range to the northern part of the Gulf of Mexico. Four of these specimens have tail lengths of 50.9-53.8 per cent of total length, a little greater than our 50.5. The tail thorns number 8 to 12 except on the one of 465 mm which has 15. Three have 2 anterior orbital thorns and 1 posterior, the others 1 anterior and 1 posterior.

The armature of the upper surface, at least on sizes up to 585 mm, is limited to the orbital thorns, a single midrow of rather inconspicuous thorns from somewhat in advance of the axils of pectorals to the first dorsal fin, and to 1 or 2 or no thorns between the dorsals. But there is not necessarily a progressive increase in the number of thorns with the size of the skate. Up to a length of about 400 mm most of our specimens have 1 anterior and 1 posterior orbital thorn, but a few, including the smallest, have 2 anterior and 1 posterior. One of 585 mm has 10 or 11, and in addition 2 aside each spiracle, while another of 488 mm has only 5 or 6 thorns along the margin of each orbit with 1 aside each spiracle.

The thorns in the midrow usually number from 8 to 14 on specimens up to a length of about 400 mm, but two of 432-435 mm have only 3 (there is evidence that some thorns were shed and others still embedded), while one of 585 mm has 23, the anterior 13 being smaller than the posterior 10. The lower surface is smooth.

The immature 772 mm holotype has 12 small thorns along the anterior and inner margins of each orbit with 3 very small ones in advance of these while the midrow contains 25 small thorns of assorted sizes, with a few rather large ones. The lower surface is densely prickly in advance of axis through the mouth, except for a nearly smooth area immediately in front of mouth. A band of prickles extends along the margin of the disc from the snout to about opposite the 4th or 5th gill openings, the remaining lower surface, including the tail, being virtually smooth.

The maximum angle of the disc in front of spiracles ranges from 81° to 94°, except 74° on the holotype. The teeth range in number from 27 to 38 in each jaw, and have a low triangular cusp, even on the smallest specimens of both sexes. In color, the smallest specimens are light brown above, with vague dark brown irregular spots about half as large to as large as the orbit, and the tail has 5 dark bars about equally spaced. The lower surface is whitish with a narrow dusky margin on the outer angles of disc. Our larger specimens lack the spots, and below are usually plain grayish white, some of them partly brownish. All, small to large, have dark-ringed mucous pores on the under surface, most numerous anterior to the axis through the mouth and immediately below the lower jaw.

It is of interest that all of the many specimens so far collected have been taken within the rather limited depth range of 160-225 fathoms (293-412 m), although many trawl hauls, both shoaler and deeper, have been made within the known latitudinal range of this species.

### RAJA FULIGINEA Bigelow and Schroeder 1954

Until recently this species had been known only from the holotype, a juvenile male 306 mm long, USNM No. 163367, taken at "Oregon" station 534, in the northwestern part of the Gulf of Mexico, 27°32′N, 93°02′W, in 400-450 fathoms (732-823 m). A second specimen, a female of 330 mm, was trawled at "Oregon" station 4147, about 45 miles southwest of Dry Tortugas, Florida, 24°12′N, 83°32′W, in 500 fathoms (915 m) (Bigelow and Schroeder, 1965).

We now have 14 more specimens, as follows: 9 from the western and northern parts of the Gulf of Mexico, "Oregon" stations 4701, 4711, 4713, 4802; 2 off Isla del Rosario, Colombia, station 4883; 1 from about 40 miles northwest of Caracas, Venezuela, station 4449, and 2 off Curaçao, station 4416, males and females evenly divided, total lengths 224-445 mm. The range in latitude is from 27°42′ to 10°15.5′N, in longitude from 96°00′ to 67°38′W. All were taken in 500-600 fathoms (915-1098 m).

In our original account (1954), *fuliginea* was compared with *R. bathyphila* Holt and Byrne 1908 which it most closely resembles in general arrangement of thorns and prickles, in proportional dimensions and in the very dark coloration of the lower surface of disc and tail. But *fuliginea* differs from *bathyphila* in a more obtuse anterior contour and especially in the fact that the entire lower surface of the tail, apart from a very narrow median stripe, is densely prickled from base to tip, whereas it is naked in *bathyphila*.

Also, the prickles on the upper surface of disc and tail are coarser than on *bathyphila* and there are no naked areas.

Proportional dimensions in per cent of total length of all 14 specimens:

Disc. Extreme breadth 43.7-51.8; breadth across anterior margin of orbits 24.6-28.6; length 37.5-49.0.

Snout length. In front of orbits 9.1-10.3; in front of mouth 10.0-13.2.

Orbits. Horizontal diameter 3.4-4.6; distance between 2.7-3.6.

Spiracles. Length 2.1-2.9; distance between 5.7-7.3.

Mouth. Breadth 5.3-7.8.

Exposed nostrils. Distance between inner ends 6.2-7.3.

Gill openings. Length, 1st 1.4-1.8; 3rd 1.4-1.8; 5th 1.1-1.5; distance between inner ends, 1st 10.7-14.8; 5th 5.8-8.5.

First dorsal fin. Height 2.5-3.6; length of base 4.6-6.1.

Second dorsal fin. Height 2.5-3.5; length of base 4.5-6.3.

Pelvics. Anterior margin 10.1-13.4; origin to tip 13.4-17.5.

Distance. From tip of snout to center of cloaca 35.2-44.0; from center of cloaca to 1st dorsal 42.4-48.8; to tip of tail 56.0-64.8; from rear end of 2nd dorsal to tip of tail 2.7-4.5. Interspace: 1st and 2nd dorsals 0.0.

In armature, the upper surface of the disc, tail, and posterior lobe of pelvics, is densely covered with small sharp prickles. The dorsals, caudal fin, and the skin over eyes also are prickly. The orbital thorns, in various combinations, range from 2 at the inner margin of each orbit to 5 or 6 at the anterior and inner margins. There may be, in addition, a thorn aside one or both spiracles, or this thorn may be lacking at both. All these thorns are usually rather prominent but are very small on several specimens. The thorns on the nuchal-scapular region are in most cases arranged in a triangular patch, with 2 to 4 in the midrow and 1 or 2 on each side of these, the exceptions being 3 on each side, or none, only 1 thorn in the midrow and, on a male of 445 mm, all the nuchal-scapular thorns are lacking. The thorns in the midrow, including the nuchal region, number from 15 to 29, the fewest (15 and 19) being on the larger specimens, a male of 445 mm and a female of 412 mm in total length, and the most (28 and 29) on a male of 224 mm and a female of 293 mm. They may continue from the scapular region with no interruption, or after a short space, or resume as far rearward as opposite the axils of the pelvics, and extend to the dorsal fin or fall short of the dorsal a distance as much as that between the spiracles. In addition to the midrow there is a siderow of thorns, usually irregular, beginning opposite the axils of the pectorals or as far rearward as about the tips of the pelvics and ending, when complete or nearly so, about opposite the origin of the first dorsal. But on some specimens the row runs out well in advance of the dorsal, and on one, a male of 428 mm, the row is virtually nonexistent, there being only 2 or 3 thorns on each side of the midrow. The thorns in the side row may be of the same size as those in the midrow, or somewhat larger or smaller.

The lower surface of disc and pelvics is smooth but the tail is densely set with prickles or thornlets, similar to those of the upper surface, but on some specimens these are lacking or sparse along a very narrow median stripe.

The color of the disc and pelvics is plain grayish above, ranging from light to rather dark. The tail may be of the same hue or somewhat paler. Below, the disc and pelvics are dark gray (3 specimens), dark brown (7 specimens), or blackish brown (4 specimens) some with pale areas around the entrance to cloaca and/or on end of snout, around the jaws, and at tips of pelvics. The tail is of the same shade, or slightly darker than it is above.

### RAJA LENTIGINOSA Bigelow and Schroeder 1951

Many specimens of this skate, 80 to 435 mm in total length, have been trawled by the "Oregon" in the Gulf of Mexico, where it is widespread, southward to the offing of Nicaragua (11°27′N, 83°11′W) within depths of 29-305 fathoms (53-558 m). The present collection includes 6 more of 226-418 mm, from the northern Gulf taken in 100-240 fathoms (183-439 m), "Oregon" stations 4614, 4616, 4696, 4705.

There is a band of thorns along the median zone of back and tail, in 3 rows anteriorly, thence merging to 5 rows, and again in 3 rows as the tail narrows. These thorns have been described as originating in the nuchal region but we have since seen many specimens on which the band begins posterior to the nuchal region as much as the distance from tip of snout to rear margin of orbits. In some instances the median row originates slightly in advance of the side rows, but usually it begins posterior to them.

The upper surface everywhere is densely freckled with light to dark brownish and whitish spots, including the tail, pelvics and claspers, distinguishing *lentiginosa* from *R. garmani* (Whitley, 1939) which it closely resembles, the latter having fewer spots which are grouped mostly in a distinct rosette pattern.

The lower surface is white, variously marked with grayish which may be in the form of a group of blotches, mostly fused, on each pectoral, or a broad band with an irregular inner margin extending from opposite the first pair of gill openings to as far as the inner margin of the pectorals. Some have an elongate blotch on the claspers and a blotch on the anterior and/or posterior pelvic lobes. Tail white.

In the original account of *lentiginosa* the second dorsal and the caudal fin are shown as confluent, but we have found a few specimens with a short space between these fins.

### RAJA OLSENI Bigelow and Schroeder 1951

Previous accounts (1951b, 1953, 1962) of this species include 15 specimens, 151-568 mm long, trawled in 53-130 fathoms (97-238 m) at 9 stations by the "Oregon" and at 1 by the "Silver Bay." All were taken in the northern and northwestern part of the Gulf of Mexico. The present collection includes two males of 161-196 mm, and a female of 335 mm, from "Oregon" station 4695, 26°16′N, 90°13′W, in 50-53 fathoms (92-97 m), in the same region as above. We include this record to emphasize how restricted is the present known range of this species in spite of the many bottom trawl hauls made by the "Oregon" and other vessels in other parts of the Gulf and along the outer coast between North Carolina and the offing of the Amazon.

### RAJA TEEVANI Bigelow and Schroeder 1951

Accounts of this species (1951b; 1965) include 6 males and 11 females, 175-635 mm long, of which 4 were trawled off Pensacola, Florida (3 "Oregon" stations), 1 at the northwest edge of Great Bahama Bank, and 1 in Santaren Channel ("Silver Bay" stations), and 11 off the coasts of Honduras and Nicaragua, the latter between 16°43′ and 12°25′N (9 "Oregon" stations), in depths of 240 to 400 fathoms (439-732 m). We now have 5 more, all males, 306-840 mm long, of which 4 were taken in the northwestern Gulf of Mexico ("Oregon" stations 4703, 4709, 4729, 4800) in 300-400 fathoms (549-732 m) and 1 of 500 mm from off Riohacha, Colombia, at 11°50′N, 73°05′W (station 4911), in 175-190 fathoms (320-348 m).

*Teevani* closely resembles *R. floridana* from which it differs in having fewer orbital thorns when about half grown and larger. Thus, on sizes up to about 600 mm there are, with few exceptions, 1 or 2 anterior thorns and 1 posterior, and on the largest, of 840 mm, only 5 thorns along the margin of one orbit and 3 at the other. Whereas young *floridana* up to about 300 mm have 1 anterior and 1 posterior thorn; at 450 mm there may be as many as 8 or 9 at each orbit and on one of 772 mm, the largest seen, there are 12 along the anterior and inner margins and 3 more in advance of these.

Minute prickles are present on the upper surface of the disc on *teevani* of all sizes, on some anteriorly only, but on others scattered all over the disc. They are lacking on our *floridana,* except for the large one of 772 mm on which the end of the snout is densely covered with coarse prickles and small thorns blending into minute prickles to about opposite the spiracles, the rest of disc smooth. On the lower surface of *teevani* prickles are present anterior to the mouth and in a band along the edge of disc from near the end of snout to about opposite the first pair of gill openings, on small individuals as well as large, but *floridana* is perfectly smooth below, up to a length of at least 450 mm, though prickles are present anteriorly on the 772 mm specimen.

*Teevani* and *floridana* were in no case taken at the same station. The known range of the latter is from the offing of Cape Lookout, North Carolina to Dry Tortugas, Florida, in 160-225 fathoms (293-412 m).

### BREVIRAJA PLUTONIA (Garman) 1881

Many specimens of this species have been recorded (Bigelow and Schroeder, 1953, 1962) from the offing of Cape Lookout, North Carolina, and southward to an area centering about 30 miles southwest of Dry Tortugas, Florida, in depths of 160-400 fathoms (293-732 m), in size from 62 to 270 mm. The present collection includes 100 specimens 76-257 mm long, trawled between St. Augustine and Vero Beach, Florida, in 188-215 fathoms (344-393 m), "Oregon" stations 5075, 5077, 5089, 5097, 5115, 5231, 5233, 5483, 5484, and 7 specimens west to southwest of Dry Tortugas in 190-310 fathoms (348-567 m), stations 4335, 4356, 4558. One of the latter, 275 mm, is the largest we have seen.

### BREVIRAJA SINUSMEXICANUS Bigelow and Schroeder 1950

All the previous captures of this skate have been recorded (1950, 1953, 1962, 1965) from the northern part of the Gulf of Mexico, except for one station in the Gulf of Campeche. There are 26 specimens in the present collection, also from this region and from the western part of the Gulf off the Mexican coast. These were trawled at "Oregon" stations 3681, 4580, 4581, 4583, 4606, 4614, 4616, 4697, 4703, 4709, 4729, 4730, 4776, 4800, 4808, 4809, 4816. The range in length, including specimens taken on all cruises, is from 78 to 360 mm, and in depth of capture from 170 to 500 fathoms (311 to 915 m), except for one station at 100 fathoms (183 m).

### BREVIRAJA SPINOSA Bigelow and Schroeder 1950

Previous accounts of this species include several specimens taken by the "Albatross" during the years 1885-1886 off Delaware Bay and North Carolina, stations 2624 and 2730, in 258 and 727 fathoms (472-1330 m), respectively. These were in very poor condition, their identity as *spinosa* was doubtful, and they cannot now be found for re-examination.

Published reports (1950, 1953, 1962) record a large series of *spinosa* ranging from the offings of Charleston, South Carolina (32°58′N), to the Guianas (07°05′N), in length 77-424 mm, trawled in 150-400 fathoms (274-732 m). Eighteen more have been taken at 7 "Oregon" stations (4428, 4854, 4912, 5039, 5689, 5690, 5722), from off Colombia, from south of Curaçao, and southwest of Grenada, 115-528 mm long, from depths of 257-400 fathoms (470-732 m). Following is a description of a mature male of 528 mm, much larger than any male previously seen (332 mm).

Proportional dimensions in per cent of total length.

Disc. Extreme breadth 58.5; length 46.2.

Snout length. In front of orbits 8.7; in front of mouth 10.4.

Orbits. Horizontal diameter 4.6; distance between 3.5.

Spiracles. Length 4.1; distance between 6.1.

Mouth. Breadth 7.4.

Exposed nostrils. Distance between inner ends 7.0.

Gill openings. Length 1st 1.3; 3rd 1.3; 5th 1.1; distance between inner ends 1st 15.5; 5th 7.6.

First dorsal fin. Height 2.6; length of base 4.2.

Second dorsal fin. Height 2.8; length of base 4.6.

Pelvics. Anterior margin 13.6.

Distance. From tip of snout to center of cloaca 42.7; from center of cloaca to 1st dorsal 44.7; to tip of tail 57.3; from rear end of 2nd dorsal base to tip of tail 3.8. Interspace 1st and 2nd dorsals 0.0.

Disc obtusely rounded in front, thence concave toward outer corners which are broadly rounded; posterior margin rounded;

maximum angle in front of spiracles 135°; width across anterior edge of orbits 28.5 per cent of total length of specimen. Axis of greatest breadth 75 per cent of distance rearward from tip of snout to axils of pectorals.

Thorns in the nuchal-scapular region in a triangular patch, continuing in a band of 5 rows along back, without interruption, and on to tail, where they are somewhat larger and in 5-6 rows anteriorly, thence narrowing to 2-3 rows, ending at first dorsal; anterior and inner margins of orbits with a row of 7 or 8 thorns, also a pair opposite each spiracle; a patch of prominent and sharp malar thorns opposite the spiracles and orbits, the length of patch about 70 mm and greatest width 20 mm; alars in as many as 4 rows, the longest row 70 mm; disc and tail covered with fine close-set prickles, coarsened in advance of the short triangular rostral process; prickles present on skin over eyes and on dorsal and caudal fins, also a few on posterior lobes of pelvics. Lower surface of disc and tail smooth.

The claspers extend from the axil of pelvics a distance a little greater than from tip of snout to rear margin of orbits.

Jaws strongly arched centrally. Teeth $\frac{37}{36}$, uppers in center of jaw crowded, with slender to narrowly triangular cusps, those toward corners of jaw arranged in parallel rows, not in quincunx; lowers similar, but those in median sector larger than corresponding upper teeth.

Color above plain medium brown, dorsals and caudal fins blackish; below, black except pale around jaws, on nasal flap, edges of gill openings, in areas near end of snout, and at tip of anterior pelvic lobes.

### CRURIRAJA RUGOSA Bigelow and Schroeder 1958

This skate appears to be relatively common within its known geographic and depth ranges. We have previously recorded (1958, 1962, 1965) 103 specimens from numerous localities extending from the northern part of the Gulf of Mexico to the northern coast of Panama, the latter at 9°03′N, 81°18′W. These ranged in length from 90 to 485 mm and were trawled in depths of 200-500 fathoms (366-915 m).

The present collection includes 19 *rugosa* of 100-404 mm, from 250-550 fathoms (457-1007 m), taken at "Oregon" stations 4414, 4662, 4663, 4730, 4731, 4816, 4883, 4902, 5039, and "Silver Bay" station 5142. Most are from within the geographic range given above, but included are four additional localities: (1) the north coast of Haiti, (2) the coast of Colombia, (3) southwest of Curaçao, and (4) southwest of Grenada at 11°40′N, 62°33′W.

## Family PSEUDORAJIDAE

### PSEUDORAJA ATLANTICA Bigelow and Schroeder 1962

Many specimens of this species have been recorded (1962, 1965) from off the Atlantic coast of Nicaragua, 13°31′N, to the offing of the Amazon River, 01°45′N, in depths of 135-350 fathoms (247-640 m), in length 86-481 mm. The present collection includes 32 males and 22 females trawled at 25 "Oregon" stations from off the coast of Panama 9°47′N, 79°25′W to the vicinity of Tobago, 11°31′N, 60°51′W, in depths of 200-340 fathoms (366-622 m), in length 90-518 mm.

Mature males have a patch of malar thorns along the outer part of the pectorals from end of snout to a little in advance of a line through the orbits. These prominent thorns may have sharp tips or be covered by skin. A few may be present on individuals as small as 350 mm but in sizes upward of about 420 mm, they are well developed.

The alar thorns usually start to appear at about 400 mm. On a specimen of 425 mm they are in 2 to 3 rows, on one of 447 mm up to 6 rows, but on the largest male of 491 mm there are only 3 to 4 rows of thorns. The size of the patch of thorns ranges from about 40 to 48 mm in length and 9 to 12 mm in width, usually with but 1 or 2 thorns at the anterior and posterior ends.

The claspers on a 230 mm specimen are minute and do not reach the tip of the posterior pelvic lobe; at 340-400 mm they reach a little beyond the pelvic lobe and at maturity, when they have become rigid, they extend for a considerable distance.

## Family ANACANTHOBATIDAE

### ANACANTHOBATIS AMERICANUS Bigelow and Schroeder 1962

Published accounts (1962, 1965) of this species include 51 specimens taken at 12 "Oregon" stations from off the coasts of British Guiana, Venezuela, Panama, and Honduras, 7°34′ to 16°35′N, in 100-400 fathoms (183-732 m), ranging in length from 95 to 350 mm. The present collection includes 42 specimens taken at 15 "Oregon" stations (4412, 4413, 4415, 4416, 4424, 4841, 4842, 4854, 4855, 4902, 4912, 4925, 5039, 5689, 5690) all from off the coasts of Colombia and Venezuela between 09°02′-12°30′N and 76°31′-69°18′W, and "Silver Bay" station 5142 off the north coast of Haiti at 19°52′N, 71°58′W, in depths of 205-500 fathoms (375-915 m), in length 114-362 mm.

The size at which males reach maturity varies. Thus, on one of 270 mm the claspers are minute, and while one of 295 mm is mature, with rigid claspers, hooks exposed, pelvics and pectorals separated, another of 320 mm is immature, with flexible claspers and the pelvics and pectorals still united. The alars at maturity are in up to 5 rows, the patch of thorns on the largest male, of 350 mm, being 29 mm long and 10 mm wide.

### ANACANTHOBATIS LONGIROSTRIS Bigelow and Schroeder 1962

Three specimens of this bizarre skate have been recorded (1962, 1965): a female of 507 mm, the holotype, from off the Mississippi Delta, 29°09′N, 87°53′W, in 500-575 fathoms (915-1052 m), "Oregon" station 2823; a male of 135 mm from Santaren Channel, 23°59′N, 79°43′W, in 350 fathoms (640 m), "Combat" station 450; and an immature male of 483 mm from the same locality, 23°40′N, 79°13′W, in 290 fathoms (530 m), "Silver Bay" station 2458.

Two more have been trawled, both females, of 745 and 630 mm respectively, off the north coast of Haiti at 19°55′N, 72°00′W, in 470-500 fathoms (860-915 m), "Silver Bay" station 5146. Proportional dimensions in per cent of total length (exclusive of filament at tip of snout) of both specimens follow:

Disc. Extreme breadth 61.2, 56.3; length 74.3, 64.7.

Snout length. In front of orbits 33.0, 30.1; in front of mouth 35.5, 33.1.

Orbits. Horizontal diameter 2.8, 2.7; distance between 3.8, 2.9.

Spiracles. Length 1.6, 1.0; distance between 6.1, 5.7.

Mouth. Breadth 5.3, 5.1.

Exposed nostrils. Distance between inner ends 5.5, 4.9.

Gill openings. Length, 1st 1.0, 1.0; 3rd 1.0, 1.0; 5th 0.7, 0.8; distance between inner ends, 1st 11.6, 10.8; 5th 8.2, 7.3.

Pelvics. Length of anterior limb 15.3, 12.0; distance, origin of anterior limb to tip of posterior lobe 13.3, 13.2.

Distance. From tip of snout (from base of filament) to center of cloaca 61.7, 57.1; from center of cloaca to tip of tail 38.3, 42.9.

The axis of greatest breadth of the disc is about two-thirds the distance back from tip of snout to axils of pectorals. The upper caudal fin is vestigial on the 745 mm specimen and the lower caudal appears to be missing, while on the one of 630 mm the tip of tail is lacking, total length having been estimated on the basis of the disc width. The proportional dimensions of the latter specimen agree closely with the holotype but the one of 745 mm has a longer snout, 33.0 per cent of total length of specimen; vertical length of disc, 74.3 per cent; wider disc, 61.2 per cent; and a greater distance from tip of snout to center of cloaca, 61.7 per cent, these proportions on the holotype being 29.8, 64.7, 56.8 and 57.4 per cent, respectively.

### SPRINGERIA FOLIROSTRIS Bigelow and Schroeder 1951

Many specimens of this species have been recorded (Springer and Bullis, 1956; Bigelow and Schroeder, 1951a, 1965), all of them from the northern part of the Gulf of Mexico, ranging in latitude from 26°46′ to 29°30′N, in longitude from 85°09′ to 96°20′W, from depths of 164 to 280 fathoms (300-512 m), in length from 125 to 620 mm.

In our last account of *S. folirostris* a description was given of a male, of 576 mm, the first mature specimen to come to our attention. This showed that on males the posterior lobe of the pelvics ceases to be adnate to the pectorals when that stage of growth is attained, as occurs with *Anacanthobatis americanus.*

The present collection includes three females 140-330 mm long and a male of 195 mm, from 27°56′N, 90°36′W, in 220 fathoms (402 m), "Oregon" station 4704, also a nearly mature male of 530 mm from 27°45′N, 93°56′W, in 200 fathoms (366 m), station 4606.

Proportional dimensions in per cent of total length of the 530 mm male.

Disc. Extreme breadth 52.0; length 54.7.

Snout length. In front of orbits 21.0; in front of mouth 22.5.

Orbits. Horizontal diameter 3.4; distance between 2.2.

Spiracles. Length 1.0; distance between 5.5.

Mouth. Breadth 4.7.

Exposed nostrils. Distance between inner ends 4.5.

Gill openings. Length 1st 0.76; 3rd 0.76; 5th 0.66; distance between inner ends, 1st 9.5; 5th 4.9.

Caudal fin. Length of base, upper 4.7; lower 4.2.

Pelvics. Length of anterior limb 13.0; origin of anterior limb to tip of posterior lobe 11.0.

Distance. From tip of snout (from base of tentacle) to center of cloaca 47.5; from center of cloaca to tip of tail 52.5.

These proportions agree closely with those of the holotype, a male 400 mm long.

The pectorals and pelvics are free, as on a fully mature male. The claspers, which are semi-flexible and with the hooks not yet exposed, extend beyond the tips of the pelvics a distance equal to the space between the outer margins of the spiracles. The alar thorns have broken through the skin but are not fully developed, the greatest width and length of the patch, on each side, being 12 mm and 25 mm, respectively, with the thorns arranged in as many as 4 rows. The jaws are rather strongly arched. Teeth $\frac{29}{27}$, those in center of jaw the smallest and more crowded, with a triangular blunted cusp, those toward corners of jaw with a flat crown.

Grayish brown above, whitish below, except for some brownish blotches on the posterior segment of the pelvic limb and a broad band of pale gray along the outer margin of the disc.

## ADDENDUM

Illustrations are included in the following publications by Bigelow and Schroeder, all listed in the references cited.

| | |
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| *Torpedo nobiliana* . . . . . . . . . | 1953, figs. 22, 23 |
| *Diplobatis pictus* . . . . . . . . . . | 1962, pl. 1 |
| *Raja bullisi* . . . . . . . . . . . . . . . | 1962, fig. 1 |
| *Raja cervigoni* . . . . . . . . . . . | 1964, fig. 1 |
| *Raja clarkii* . . . . . . . . . . . . . . | 1958, fig. 8; 1965, fig. 1 |
| *Raja floridana* . . . . . . . . . . . | 1962, figs. 2, 3 |
| *Raja fuliginea* . . . . . . . . . . . . | 1954, fig. 4 |
| *Raja lentiginosa* . . . . . . . . . . | 1951b, fig. 1; 1953, fig. 48α |
| *Raja olseni* . . . . . . . . . . . . . . . | 1951b, fig. 2; 1953, fig. 54α |
| *Raja teevani* . . . . . . . . . . . . . | 1951b, fig. 3; 1962, fig. 3 |
| *Breviraja plutonia* . . . . . . . . . | 1953, figs. 67, 68 |
| *Breviraja sinusmexicanus* . . . . | 1950, pl. 5; 1953, fig. 69 |
| *Breviraja spinosa* . . . . . . . . . . | 1950, pl. 6; 1953, fig. 71 |
| *Cruriraja rugosa* . . . . . . . . . . . | 1958, figs. 10, 11; 1962, fig. 10 |
| *Pseudoraja atlantica* . . . . . . . . | 1962, figs. 11, 12, 13; 1965, fig. 6 |
| *Anacanthobatis americanus* . . | 1962, figs. 14, 15, 16; 1965, fig. 7 |
| *Anacanthobatis longirostris* . . | 1962, figs. 17, 18; 1965, fig. 8 |
| *Springeria folirostris* . . . . . . . . | 1951a, fig. 1; 1953, fig. 78α; 1965, fig. 9 |

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